

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Bram Turkstra
Student number	4802470

Studio		
Name / Theme	AR3AH105 – Heritage & Architecture – Resourceful housing studio Adapting 20 th century heritage	
Main mentor	Uta Pottgiesser	Architectural engineering + technology
Second mentor	Telesilla Bristogianni	Department materials mechanics, management & design
Third mentor	Paddy Tomesen	Architectural engineering + technology
Argumentation of choice of the studio	The choice of this studio is my personal preference for heritage buildings. During the studio selection process it became clear that this studio offered a good mix between working with heritage and practical development. A location in the Netherlands was also of added value. As I had already worked on heritage buildings as a designer, I developed a certain fondness for these buildings. I also realised that there is often little that can be done with these buildings other than restoration, and that it is not always easy to use sustainable materials because they have to be restored in the old style with contemporary materials. With this knowledge and passion as a basis, I chose the Heritage graduation studio to further develop myself in the built environment with heritage value.	

Graduation project	
Title of the graduation project	Harmonizing Heritage & Sustainability
Goal	
Location:	Wereldbibliotheek, Admiraal de Ruijterweg 545-547
The posed problem,	In today's Dutch urban environment, housing development faces challenges due to traditional linear construction using non-renewable materials, contributing to significant environmental impact. The construction industry's reliance on concrete and steel, often produced from non-renewable raw materials, leads to substantial carbon and nitrogen emissions and water usage (Gagg, 2014). Efforts like re-use initiatives and circular construction methods aim to counteract this, advocating for the re-use of building materials to reduce environmental strain. While these initiatives benefit

	<p>sustainability, challenges persist in the initial use of non-renewable materials, negatively impacting emission levels and the climate (Ethical Unicorn, 2020).</p> <p>Moreover, the preservation of heritage structures in the Netherlands, driven by limited urban expansion space, involves strategies like densification within existing urban limits and redevelopment (Nederland is druk en vol (column), 2018). However, these processes often continue to use non-renewable materials, posing obstacles for environmental sustainability.</p> <p>To address this, transitioning the construction industry's front end away from non-renewable materials is proposed. The adoption of bio-based materials is a key solution, offering a sustainable alternative that aligns with circular practices and climate goals. Integrating these materials into heritage preservation is a forward-looking strategy, seamlessly combining historical authenticity with ecological responsibility. Bio-based elements such as natural wood, lime, or earth-based plasters rejuvenate aging structures, fortifying resilience against environmental pressures while ensuring cultural significance endures for future generations, thus harmonizing tradition and innovation in architectural conservation (Ben-Alon et al., 2019).</p>
<p>research questions and</p>	<p>Main question: "How can bio-based materials enhance sustainability and circularity in architectural renovation while prioritizing the conservation & preservation of architectural heritage?"</p> <p>Sub-questions: What criteria should there be stated in order to select bio-based materials suited for location specific architectural heritage renovation? What are the distinct categories and characteristics of bio-based materials available for architectural renovation and how can their performance be assessed and compared? What are the cultural and historical considerations when selecting bio-based materials for heritage preservation in architectural renovation and how can already existing architecture show the possibilities of applying bio-based materials? What are the implications for architectural heritage renovation when transitioning from traditional building materials to bio-based materials?</p>
<p>design assignment in which these result.</p>	<p>The first idea for the influence of this research on the design later on is to work with a building where new additions and interventions are as much as possible made with bio-based building materials and where the design can draw inspiration from these natural materials in order to</p>

	cut down on emissions, waste materials and linear processes but still maintain the heritage value and image of that building and adding a new layer of heritage to this existing structure. The building is to form an example for future architecture on how to work, design and live with bio-based materials.
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Process

Method description

For this research, the idea is to use sources that provide insights into the different kinds bio-based materials available, their parameters for comparison, any heritage values and projects where certain bio-based materials are applied. That would give the first part of the research insight into the overall possibilities, options and criteria to pay attention to. Then, further investigation into the use of those materials can provide the needed information on the possible needed changes to the existing techniques used in construction. This will form a sustainable pre-selection that allows to assess the worth (or not) of applying bio-based materials before testing which is actually suitable for application.

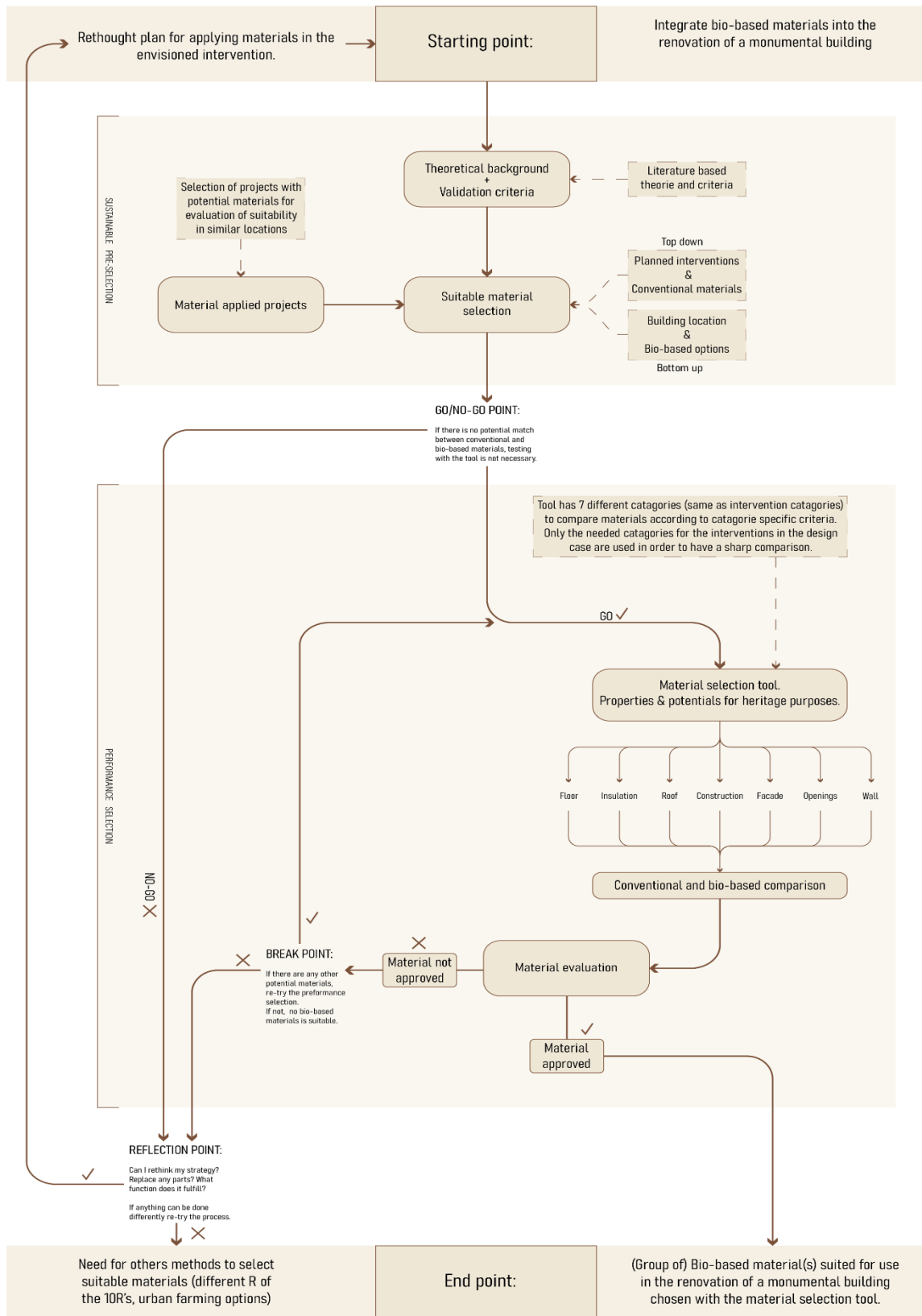
Therefore giving a total overview of usable materials, but also in depth assessment of the extent to which these materials are suitable for use in preserving heritage and making the construction sector more sustainable.

Keeping this in mind, two methods are anticipated to gather the necessary information for the study. The initial approach involves creating a comprehensive framework of information across different subjects to establish a sustainable pre-selection, as outlined in the framework on the right. This interdisciplinary framework is developed using various literary resources. The outcomes of the sustainable pre-selection involve, first, the formulation of validation criteria based on a theoretical background. Secondly, the process includes selecting suitable materials by forming a database with parameters to evaluate bio-based materials for application. This selection process will be expanded with insights into heritage values, building applications, and material-applied projects. The resulting database will include potentially suitable materials with background information on applying materials while respecting the heritage value of a building. It will also provide insights into specific heritage values to consider when altering a building and showcase architectural projects that have already used specific bio-based materials, offering valuable insights into their practical application.

The second method delves into the practical facet of this research. Leveraging the established database, a tool can be formulated to facilitate material selection for application in a project. This second segment serves as a performance selection, offering users the capability to assess material suitability and, if not, assisting in determining the correct utilization of the tool. Furthermore, this performance entails an examination of the implications for building techniques and potential adjustments the sector may need to accommodate.

The performance selection, as depicted in the framework on the right, follows a circular process to identify a suitable material. Within this circular trajectory, three breakpoints are identified. Initially, before commencing the selection cycle, a GO/NO-GO point is established. If the database reveals no materials suitable for testing with the tool, initiating the testing process becomes futile. This leads to the REFLECTION POINT, designed to assess the appropriateness of the approach. Minor adjustments to the approach at this juncture can potentially yield a positive outcome. The circular process also encompasses a BREAK-POINT. If a material is deemed unsuitable for application, the BREAK-POINT offers two alternatives. If no more potentially suitable materials are available, the process transitions to the REFLECTION POINT. Alternatively, if there are still potentially suitable materials, the circular process recommences to evaluate the material's approval. Overall, this makes the research both theoretical and practical. This is because the dual framework provides an auxiliary

direction for applying bio-based materials in different situations. In addition, it is practical because it also immediately shows how it can be used in practice by providing the various material applied projects and helping with applying materials into projects.



Literature and general practical references

Firstly, the data needed consists of information and properties about the materials to make an informed consideration about their usability. In addition, sources are needed to help determine the application and which conventional building material it can replace.

Furthermore, resources to help formulate the criteria are also needed. Finally, projects that apply the materials should be selected to see what can be learned from them for further design assignments. This gives a total of 4 different types of data to be collected. The first two mentioned are sought by consulting literary sources and books. The latter will come from comparing different projects to find suitable ones for this research.

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

Firstly, to make the relationship between the project and the studio clear, the project is located in Amsterdam West, the focus of the studio. In addition, the project aims to create housing in a building that is currently not being used as efficiently as it could be. This ties in with the studio's theme of resourceful housing. The project is doubly relevant to the Master's in Architecture, in that it looks at the architecture of an earlier period and seeks to complement and preserve it with the architecture of a future period. This makes it an appropriate study within the Architecture track. In addition, by investigating materials and their properties in order to arrive at a suitable selection, it also partly fits the direction of the Building Technologies track. Finally, the desire to fit in with the context and to see what heritage values can be brought back from an urban point of view is also a starting point that connects with the Urbanism track. As a result, the research into potential design fits well with the entire MSc AUBS Master's programme.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Research has shown that much of the Dutch housing stock is in need of sustainability improvements. One of the reasons for this is poor thermal insulation. This is the case for about 50% of the housing stock, and these were also built before 1970, so they may have significant heritage value, but were not built with any climate regulations. Now that the preservation of the housing stock, 2050 regulations, is also required by European directives, in addition to a shift towards sustainable materials, it is of great value to address this issue in an integrated manner. The present study addresses both issues. Firstly, by looking at bio-based materials that can be used, and secondly, by doing this in combination with heritage buildings and values. This offers a potentially new way of making the built housing stock sustainable for the future with materials that are also better for the environment, without compromising the heritage values of the building.